

## Helminths of the oak toad (*Bufo quercicus*, Bufonidae) from Florida (U.S.A.)

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**The gastrointestinal tracts, lungs and urinary bladders of 35 *Bufo quercicus* from Florida (U.S.A.) were examined for helminths. Four genera of nematodes (*Ascarops*, *Cosmocercoides*, *Filaridae* gen. indet. and *Physaloptera*) and one genus of acanthocephalan (*Polymorphus*) were found. The highest prevalence was 11% for *Cosmocercoides*, and the greatest mean intensity was 4.5 for *Ascarops* sp. *Bufo quercicus* is a new host record for each of these genera of helminths.**

The oak toad, *Bufo quercicus* Holbrook, 1840, occurs in pine woods of the southern coastal plain from southeast Virginia throughout Florida to eastern Louisiana (CONANT & COLLINS, 1991). It is the smallest bufonid in the United States, reaching a maximum size of only 38 mm (ASHTON & ASHTON, 1988). To our knowledge, there are only two reports of helminths in oak toads (WALTON, 1938; HAMILTON, 1955). With worldwide attention focussed on declining amphibians (HEYER et al., 1994), knowledge of the occurrences of helminths and their possible negative impact on anurans has become a topic of interest. The purpose of this paper is to report the occurrences of helminths in a Florida population of *Bufo quercicus* as part of an ongoing study of the biogeography of North American bufonid helminths.

Thirty five *Bufo quercicus* from Florida, U.S.A. (30 males, 5 females, mean snout-vent length SVL = 27.9 mm  $\pm$  2.8 SD, range 24-35 mm) were borrowed from the herpetology collection of the University of Florida, Gainesville: UF 9602.1-19, collected April, 1957, Palm Beach County; UF 66801-66810, collected July 1970, Leon County; UF 100225-100230, collected May-June 1977 or 1978, Marion County.

The toads were dissected in situ, i.e. without removing organs from the body. The body cavity was opened by a longitudinal incision from throat to vent. The lungs, esophagus, stomach, small intestine, large intestine and bladder were examined under a dissecting microscope. All helminths were removed and identified using a standard glycerol wet mount procedure. Terminology is in accordance with MARGOLIS et al. (1982).

Ten (29 %) of the 35 *Bufo quercicus* harbored helminths. Nematodes included five adult females of *Cosmocercoides* sp., three third-stage larvae of *Physaloptera* sp., nine encapsulated larvae of *Ascarops* sp., two third-stage larvae of Filariidae gen. indet. and two acanthocephalan cystacanths, *Polymorphus* sp. Helminths were found in the stomach, large intestine and coelom; none were found in the lungs, esophagus, small intestine or bladder. Voucher specimens were deposited in the United States National Parasite Collection, Beltsville, Maryland 20705, U.S.A.: *Ascarops* sp. (85877-85878); *Cosmocercoides* sp. (85879-85881, 85886); *Physaloptera* sp. (85876, 85882, 85885); Filariidae (85884); *Polymorphus* sp. (85883, 85887).

One female and two male toads from Leon County and one female from Marion County harbored five adult females of the genus *Cosmocercoides* (prevalence: 11 %). This represents the highest prevalence found for a helminth in our study. These nematodes were found in the large intestines. Since male nematodes were absent from the collection, it was not possible to determine the species. *Cosmocercoides dukae* has previously been reported from *Bufo quercicus* (WALTON, 1938); however, the collection locality was not stated. *Cosmocercoides variabilis* (previously known as *Oxysomatium variabilis*) was found in *B. quercicus* from Florida and/or Georgia (HAMILTON, 1955). Only two species of *Cosmocercoides* have been reported from North America, namely *C. dukae* and *C. variabilis* (BAKER, 1987). These two species have caused some taxonomic problems in that *C. variabilis* was at one time considered to be a synonym of *C. dukae*. However, VANDERBURGH & ANDERSON (1987a-b) showed that such synonymy was incorrect and reported *C. variabilis* to be a normal parasite of the Bufonidae, while *C. dukae* is normally a parasite of molluscs but may occur accidentally in frogs and salamanders which feed on molluscs (VANDERBURGH & ANDERSON, 1987c). Thus, the specimens recorded by WALTON (1938) should be referred to *C. variabilis*.

One female and one male toads from Marion County and one female from Palm Beach County harbored three third-stage larvae of *Physaloptera* sp. (prevalence: 9 %). Two larvae were found in stomachs, one was found in the large intestine. Larval physalopterans have been found in several species of *Bufo*, namely, *B. alvarius*, *B. americanus*, *B. cognatus*, *B. debilis*, *B. microscaphus*, *B. retiformis*, *B. speciosus* (as *B. compactus*) and *B. woodhousii* (KUNTZ, 1940; PARRY & GRUNDMANN, 1965; ASHTON & RABALAI, 1978; GOLDBERG & BURSEY, 1991; GOLDBERG et al., 1995, 1996), but, apparently, no cases of parasitism of toads by adult physalopterans have been reported. The presence of larvae and lack of adult physalopterans has been reported in many other species of amphibians and reptiles (see GOLDBERG et al., 1993). Species of *Physaloptera* require an insect intermediate host (ANDERSON, 1992); thus, the presence of their larvae in insectivorous species is not unexpected. Because physalopterines are usually found attached to the gastric mucosa (ANDERSON, 1992), our finding one larva in the large intestine suggests that toads are not appropriate hosts for this species and development to maturity does not occur in them.

Two male toads from Palm Beach County (prevalence: 6 %) harbored nine encapsulated larvae of *Ascarops* sp. for a mean intensity of 4.5, highest found in our study. The cysts occurred in the stomach wall, two in one toad and seven in the other. Encapsulated larvae of *Ascarops* sp. have been found in lizards (GOLDBERG & BURSEY,

1988, 1989; McALLISTER et al., 1993), birds (KRAHWINKEL & McCUE, 1967) and mammals (ALICATA & McINTOSH, 1933; CHANDLER, 1946), but this is apparently the first record of this genus in toads. Two hosts are required for development: adults are found in the stomach of swine, rats and mice, in the esophagus of ruminants and in the crop of chickens (OLSEN, 1974); larvae develop in Coleoptera and Odonata (ALICATA, 1935). *Ascarops* sp. larvae can be expected in animals that habitually feed upon insects.

One female toad from Marion County (prevalence: 3 %) harbored two filarial larvae in the coelom. Since the reproductive system had not begun to develop, no attempt was made to identify the specimens. Apparently no adult filariids have been reported from North American toads; but, species of *Foleyellides* do parasitize *Rana utricularia spheenocephala* in Florida (BAKER, 1987). Whether filariids actually parasitize North American toads or those found in this study represent an accidental infection is not presently known. Further work will be required to answer this question.

One female and one male toads from Marion County (prevalence: 6 %) harbored two acanthocephalan cystacanths. They were in the coelom but attached to the stomach wall. These cystacanths were orange in color, about 0.5 mm in length, and appeared to lack genital spines. For these reasons the cystacanths were identified as *Polymorphus* sp. Amphipods serve as intermediate hosts and ducks serve as definitive hosts for species of *Polymorphus* (PODESTA & HOLMES, 1970). To our knowledge, there are no other reports of cystacanths in North American toads.

WALTON (1938) found one additional nematode from *Bufo quercicus*, namely *Oswaldocruzia pipiens*. Later, HAMILTON (1955) reported *Oswaldocruzia subauricularis* from *Bufo quercicus*. BAKER (1977) reviewed the North American species of *Oswaldocruzia* and concluded that a single species, *O. pipiens*, was present in North American toads and frogs. BAKER (1987) considered *O. subauricularis* to be a South American species; thus, the HAMILTON (1955) record should be referred to as *O. pipiens*.

Currently, *Bufo quercicus* may be listed as definitive host of two species of nematodes, *Cosmocercoides variabilis* and *Oswaldocruzia pipiens*, but may serve as a paratenic or accidental host for several other helminths. Prevalence is apparently low: 29 % in this study, 7 % in the study by HAMILTON (1955). Because only small numbers of specimens are available from museums for dissections, our sample was restricted to 35 *Bufo quercicus*. Examination of larger samples from throughout the range of *Bufo quercicus* may yield helminth species not previously found.

In addition to *Bufo quercicus*, the Floridian bufonid fauna consists of two native (*Bufo terrestris* and *Bufo woodhousii fowleri*) and one introduced species (*Bufo marinus*) (ASHTON & ASHTON, 1988). Apparently, there are no reports of helminths in these species in the state. Subsequent helminthological examinations will be required before the helminth fauna of these Floridian toads can be compared.

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